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Unlimited. DSM

Somos® 9120/9420 EP White User's Guide

Robust, Accurate, Functional Epoxy Resin for Stereolithography

For Solid State Laser Systems (335nm)
A White Material that Mimics Engineering Plastics

Description

DSM Somos® 9120/9420 is a liquid photopolymer that produces robust, functional and accurate parts using stereolithography machines. The material offers superior chemical resistance, a wide processing latitude and excellent tolerance to a broad temperature and humidity range during and after build. Parts created from **Somos® 9120/9420** exhibit superior fatique properties, strong memory retention and high quality up-facing and down-facing surfaces. **Somos® 9120/9420** also offers a good balance of properties between rigidity and functionality. The resulting part properties are ideal for master patterns in rubber molding applications. This material is also useful in creating parts for applications where durability and robustness are critical requirements (e.g., automobile components, electronic housings, medical products, large panels and snap-fit parts).

Application

Somos® 9120/9420 Photopolymer is used in the solid imaging process to build three-dimensional parts.

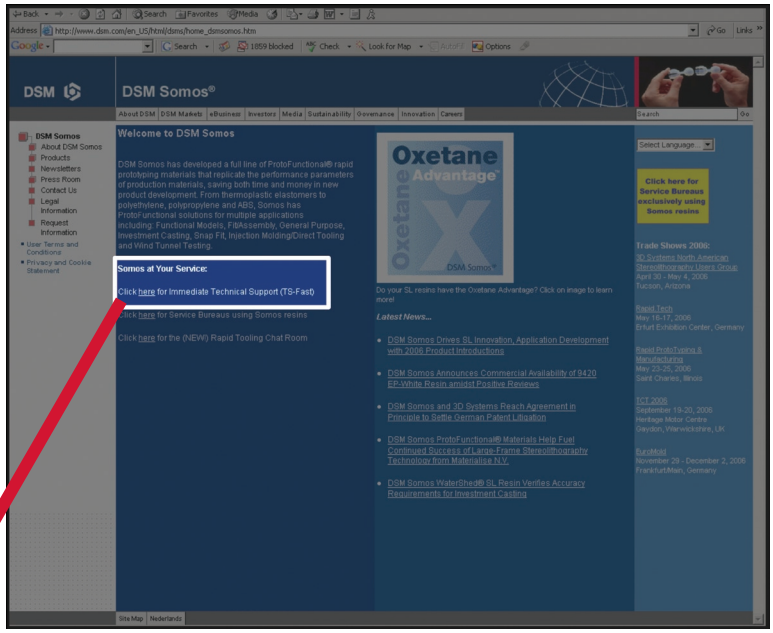
DSM Somos® 9120/9420 EP White can be used as a general purpose resin and is suitable for snap-fit parts, RTV patterns and living hinges.

Technical Service Fast (TS Fast)

For prompt response to your questions regarding the proper use of Somos® 9120 and 9420 EP-White, contact us via our TS Fast service on our website.

Log on to **www.dsmsomos.com**

From the main page, click the link in the dark blue column under “Somos at Your Service”



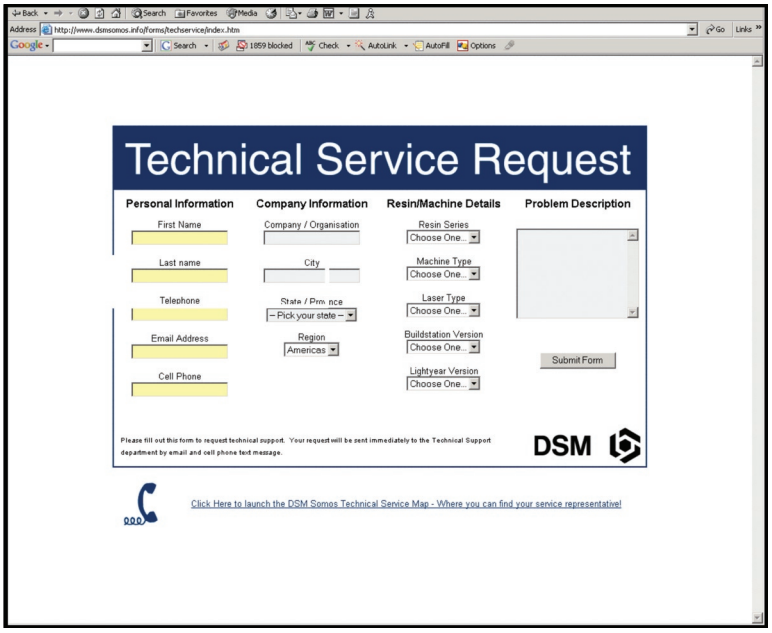
TS Fast Link

Somos at Your Service:

click here for Immediate Technical Support

Fill out all of the required information on the Technical Service Request form and click “Submit.”

Your request will be processed within 15 minutes, and a text message will be sent to a DSM technical service representative who will contact you promptly.



TS Fast Service Request Form

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To avoid personal injury, please adhere to the following guidelines:

Read and understand the Material Safety Data Sheet (MSDS) before using the resin.

Somos® 9120 and 9420 EP-White has a very low viscosity; therefore it is important to avoid contact with eyes, skin & clothing by wearing Personal Protective Equipment (PPE):

- Safety Glasses/Goggles
- Gloves
- Laboratory Coat

Keep the work area clean.

- Avoid spreading resin onto clean surfaces.
  - If resin is found on clean areas, it should be cleaned off immediately with a disposable paper towel and isopropanol.
- Wash hands regularly after handling resin.

Provide Adequate Ventilation.

- Prevent build-up of volatile substances from resins and solvents.
- **Remove dust from clean & finished parts.**

To avoid contact with partially cured resin, DO NOT touch green parts without wearing the proper PPE.

For further safety instructions, consult the Safe Handling Guide.

Storage

9420 contains a pigment that may settle out over an extended period of time while inside the container and vat of the machine.

To ensure homogeneity, the container should be rotated periodically (1X/week).

Machines left idle for an extended period should have a scheduled vat stir with the machine software (go to Setup then stir resin) for at least one hour.

Preparing the Machine

Installing a New Vat

For machine-specific vat installation and resin replacement, please consult Appendix B of this guide.

Replacing Resin

Be sure to clean out the vat thoroughly, properly disposing of used resins and cleaning materials (solvents, paper towels, etc.), and consult Appendix B of this guide.

Machine Settings

The surfaces of **Somos® 9120 and 9420 EP-White** are highly susceptible to contamination (chemicals, cured or partly cured resin and dirt). Therefore, the machine and platforms should be cleaned thoroughly before and after each time they are used.

Check to see that the Zephyr blade is clean of any residue. This can be done by running a gloved finger along each side of the blade. If there is any residue, it can be wiped off gently with the proper tool.

Remember!

- Always check the Zephyr blade after any build crash or other adverse event that may cause a change in the gap before beginning a new build.
- Also check that the resin level in the blade is set to the halfway point. On builds with large flats or trapped volumes, check that the blade isn't running out of resin and giving incomplete part recoating due to resin starvation.

Disposal of Used Resin

Partially or uncured UV material waste may be classified as hazardous in some areas, thereby requiring special packaging, transportation, and disposal. Contact the governmental body which regulates waste disposal in your area to ascertain what disposal protocols exist.

The packaging, transportation and disposal methods which are used must prevent any form of human contact with the waste, even if it is classified as nonhazardous or unregulated. This precludes the use of disposal methods which will result in groundwater or surface water contamination.

Clean-up solvents should be isolated in a sealed, marked container, and disposed of as “hazardous waste” in accordance with all applicable laws and regulations.

Clean-up materials, soiled clothing, empty containers, etc., should be disposed of in accordance with the preceding guidelines. Whenever any of these contain uncured or partially cured UV-curable materials, the disposal method must preclude any form of human contact, including any which could result in groundwater or surface water contamination.

Build Parameters

Style files will be provided by your technical service representative. If any problems arise with styles provided, use the TS-Fast system to allow the tech service team to handle the problem at **www.dsmsomos.info/tsfast**.

9120 and 9420 are very similar and will run properly if the machine is setup with the correct build styles and Ec/Dp values.

These are included in the table below.

9120 and 9420	
Ec	10.9mJ/cm^2
Dp	0.14mm (0.0056 inch)
E10	65mJ/cm^2

Cleaning Procedures

The most effective method of cleaning parts is to sequentially wash them in solvent baths of increasing purities. For parts made with Somos® 9120 and 9420 EP-White, DSM Somos® recommends washing them with TPM. After draining the platform, use the following basic steps to clean your parts:

- Wash the parts in a solvent bath (with higher levels of resin) and drain.
- Rinse parts with clean solvent
- Dry parts with compressed air

For washing parts by hand, please do the following:

- Immerse the parts in TPM for about 5 minutes with agitation. If surface appearance is not an issue, a bristle brush may also be used.
- After thoroughly draining the platform, immerse the parts in isopropanol for 5 minutes with agitation. Drain.
- Rinse the parts with isopropanol and dry with compressed air before post-curing.

For an automated wash, such as with the Ramco System, please do the following:

- In a unit containing solvent, submerge the parts for 20 minutes of agitation, followed by 5 minutes of drain time.
- Spray the parts with solvent or water, and immediately dry with compressed air.
- Spray part one last time with clean solvent, dry with compressed air, and inspect for cleaning efficiency.

Remember!

- When handling objects fabricated from **DSM Somos®** resins in a partially cured state (after initial laser cure), wear nitrile or other chemical resistant gloves to avoid skin contact.
- Because of the low viscosity of **Somos® 9120 and 9420 EP-White**, extra care should be taken to prevent drips. If a drip does occur, it should be wiped up immediately.
- All cleaning solvents should be kept clean and free of debris or excessive resin.
- When draining parts, take care not to expose them to actinic light.
- Parts can be rinsed with water after rinsing with solvent but do not let them soak in water for more than one minute.
- Wash hands regularly after handling resin.
- Parts cleaned in isopropanol alone will not be completely clean because **Somos® 9120 and 9420 EP-White** is not completely soluble in isopropanol.
- Make sure parts are completely dry (free of solvent and/or water) before placing in the post-cure apparatus, otherwise parts could be tacky.

Post-Cure Procedures

In order to achieve optimal mechanical and physical properties, parts should spend 60 minutes in the Post-Cure Apparatus (PCA).

If parts are of a suitable shape, each side should be cured for thirty (30) minutes.

Remember!

- The amount of time a part spends in the PCA correlates directly to its finished quality. In addition to inadequate exposure in the PCA, poor lamp quality can limit the strength of the part, causing further complications with secondary techniques (i.e.., rubber tooling).
- A longer exposure in the PCA with lower quality lamps is not a substitute for using better quality lamps.
- PCA lamps must be new (less than 2000 hours of use) and should be an alternating mix of Philips TLK 40@/05 and TLK 40W/03 lamps (or equivalent).
- To prevent discoloration, parts should be stored in a dark or non-ultraviolet light environment.
- Parts should be cleaned and dried completely before being placed in the PCA.
- Overcuring the parts may lead to increased stiffness while undercuring the parts may lead to sticky sidewalls

Below are documented cases of common problems and possible solutions. Consult this part of the guide if you are having difficulties, and do not hesitate to contact us via TS Fast as discussed on page 2.

Delamination occurs on the bottom layer of parts at the corners edges.

Solutions:

Make sure the “unsupported Inset” value in the FinePoint™ support editor is not too small. This will ensure that the supports attach to the edges of the bottom layer. Unfortunately this value is not retained and needs to be changed after the support generation for each part. We found that 0.010 inch (0.254 mm) worked well on our SLA-7000, but it should be determined for each machine.

Make sure there is sufficient fill cure depth on the bottom layer. Check border overcure value on supports. Use sufficient border overcure for the supports and sufficient penetration of the support into the bottom of the part.

Have the physical blade gap on your recoating blade checked. For Zephyr blades, set the blade gap to 0.004 inches (0.102 mm) For doctor blades, set the blade gap to 0.006 inches (0.1524 mm).

Watch the building of the first few layers of the part to see that the surface is being coated properly with resin. Check for signs of resin starvation or dewetting.

The part is distorted by way of shrinkage. 9120 and 9420 EP-White do not display appreciable differential shrink however if you do experience shrinkage, try one of these standard solutions

Solution:

Use minimal values of fill cure depth on the down facing layers of the part. The suggested minimum values are 0.005 to 0.006 inches (0.127 to 0.152 mm).

Ensure that there is sufficient time between the scanning of successive layers. This can be a combination of scanning time, recoating time and pre-dip delay and Z wait time. Over sixty seconds is normal for a platform of parts and should be sufficient.

Surface is not smooth and clear; it has the texture of frosted glass.

Solution:

Use slower scanning speed for both hatching and fills. Also use tight fill spacing such as 0.002 inch (0.051 mm) for the fills. Drawing speed for hatching should not exceed the calculated S_{max} or the maximum ceiling recommended for the machine. Although the hatching speed can be controlled in the build station software (hatch ceiling), the fill speed must be set by controlling the maximum laser power setting.

The top surface of the part is concave.

Solution:

Ensure that there is sufficient time between the scanning of successive layers. The time between imaging successive layers is typically sixty seconds or more. In cases where the imaging time between layers is too short, increasing the Z wait time should improve the concavity.

The top surface of the part is not smooth and level.

Solution:

Check the recoating blade to make sure the bottom surface is clean, and check the blade gap setting to make sure the blade is level and the rake is properly set. Check the resin inside the recoating blade and in the vat to ensure that they contain no foreign bits of material.

Make sure no contaminants of liquid or solid variety are introduced into the vat. If the problem persists, contact the DSM Somos® help line for other solutions.

Bottom surface of the part curls up at the outside edges and at the corners.

Solution:

Use sufficient border overcure for the supports and sufficient penetration of the support into the bottom of the part. We recommend increasing the overcure for the supports. Check that the Top Interface Intersect is appropriate for the part in question.

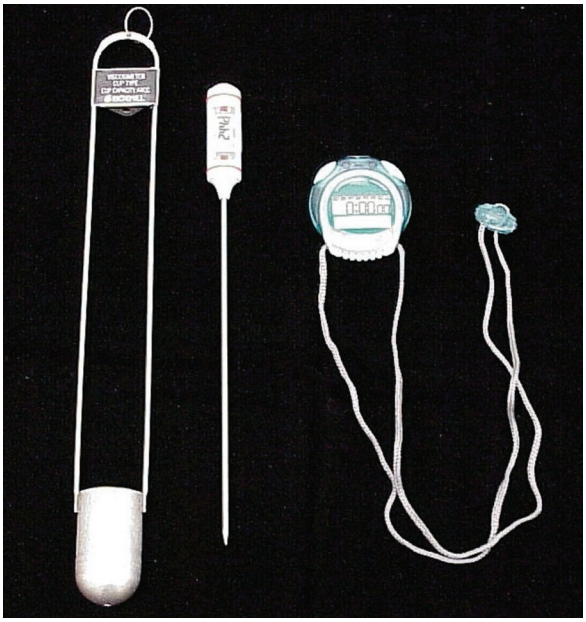
Appendix A
Viscosity Monitoring Procedure

Maintaining proper resin viscosity in your stereolithography machine is very important. The viscosity can increase over time, and this can cause problems in building parts. If the viscosity increase is severe enough, the resin may have to be replaced, resulting in significant expense and lost production time.. If increasing viscosity is identified early, the resin can be saved in most cases. Early detection of the problem can be accomplished by regularly measuring the resin viscosity. This must be done even if the machine is not used often, as resin viscosity can change even if the machine is not used.

The following procedure will explain how to measure and record the resin viscosity.

Required Equipment:

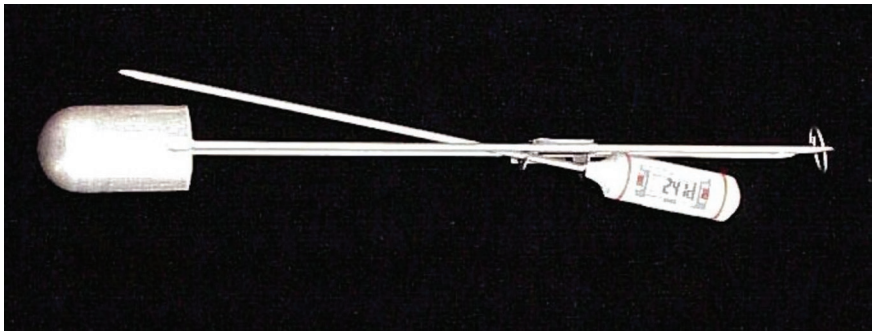
- # 4 Zahn Cup
- Thermometer (Long Stem) that mounts onto the Zahn cup handle
- Stopwatch



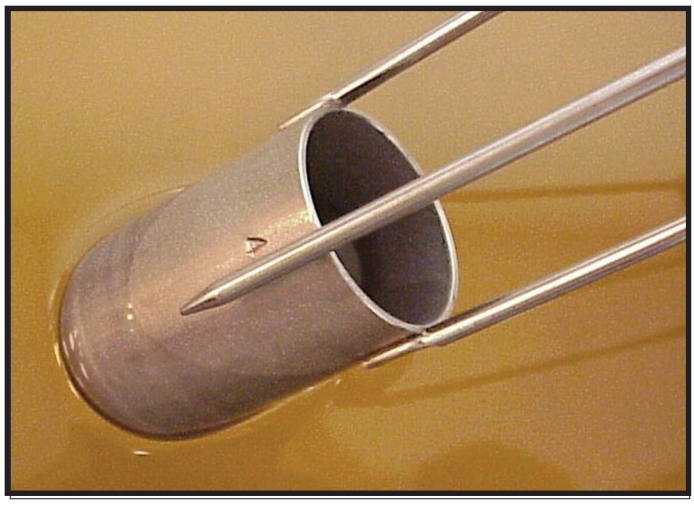
Appendix A: Viscosity Monitoring

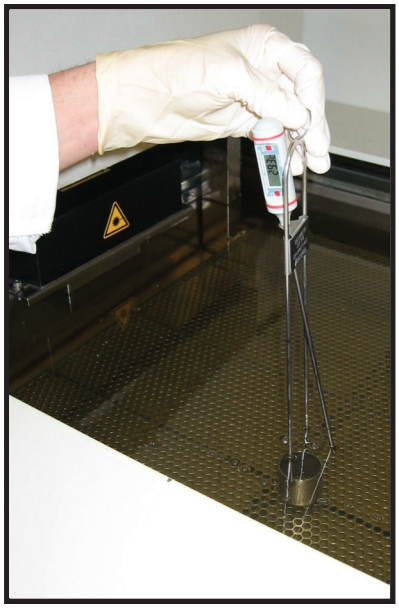
Procedure:

- Ensure that the vat temperature is at the part building temperature.
- Mount the thermometer on the Zahn cup handle and make sure that the tip of the thermometer is at the center (half way up) on the bowl. The tip of the thermometer will not be in the bowl. It will be by the side of it. Turn the thermometer on and set it to °C.



- Lower the machine platform about 100 mm below resin surface.
- Immerse the Zahn cup at a 45° angle slowly into the vat resin so that you do not create bubbles and stand it on the platform. Be careful that it does not fall into the resin.

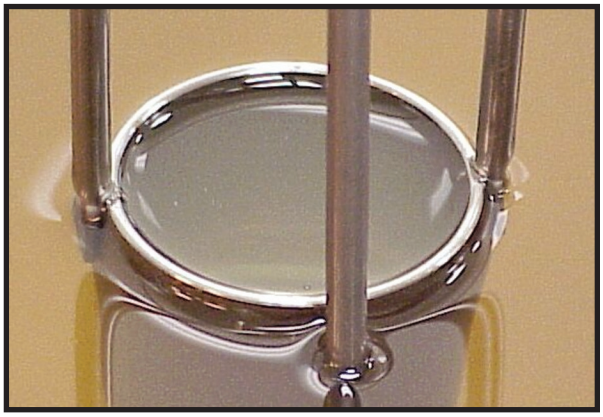




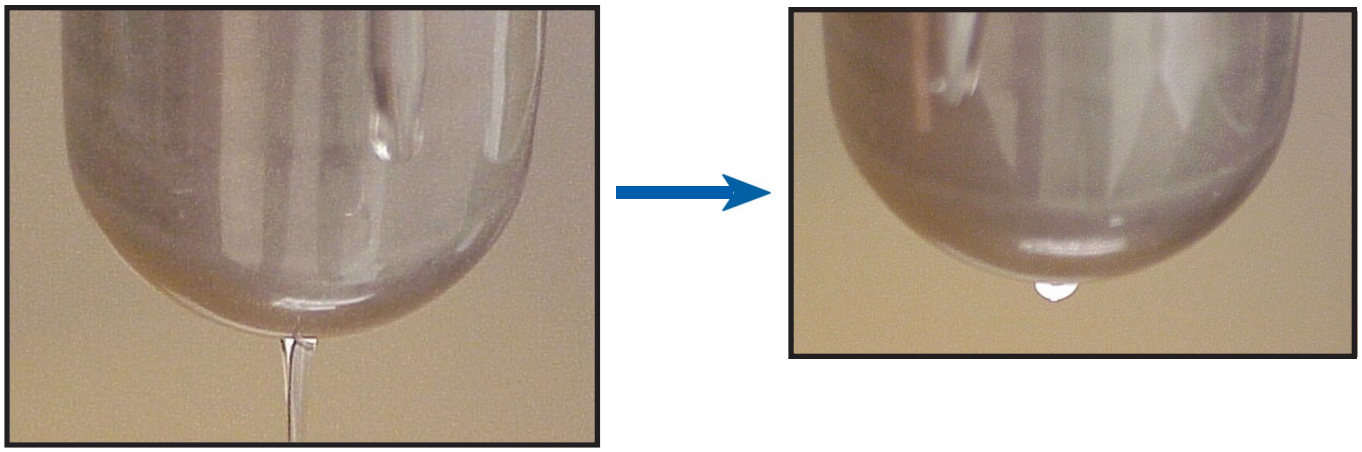
Appendix A: Viscosity Monitoring

- Monitor the temperature of the resin with the thermometer. You need to wait until the Zahn cup and resin have reached the vat temperature. When the Zahn cup thermometer reads that temperature and is steady, you are ready to take a measurement.

- Slowly lift the Zahn cup completely out of the resin. When the top surface of the cup leaves the resin, start the stopwatch.



- Watch the stream of resin flowing from the hole at the bottom of the cup. When the stream just under the cup breaks and changes from continuous to individuals drops, stop the stopwatch.



Appendix A: Viscosity Monitoring

- Read the number of seconds on the stopwatch and use the table on the following page to determine the approximate viscosity.
- Repeat the procedure to obtain at least two values that are close to each other. Turn the thermometer off to save the battery.
- Record the following data in a chart for each resin and machine: Date, Resin Temperature, Seconds readings, and Viscosity (from table). If the viscosity of the resin starts to increase, inform Somos and provide them with the data from the table.
- Clean the cup and thermometer by wiping with a paper towel. Wash the cup and thermometer stem with solvent and dry them. Do not remove the long-stem thermometer from the Zahn cup until the stem is completely clean.

Remember!

- When the resin is installed in the machine, start to measure and record the viscosity once each week.

Appendix A: Viscosity Monitoring

Seconds	Approximate Viscosity (CPS)
20	245
22	280
24	310
26	340
28	375
30	410
32	440
34	470
36	505
38	540
40	570
42	600
44	635
46	667
48	700
50	730
52	765
54	800
56	830
58	860
60	895
62	930
64	960
66	990
68	1030
70	1060
72	1090
74	1120
76	1150
78	1190
80	1220
82	1255

Appendix B
Vat Installation Procedure

For the SLA 3500, 500, 5000 and 7000, please follow these instructions for installing a new vat:

- Remove front cover of the SLA and drip pan if present
- Verify that the vat pads on the new vat are the same type and same position as the pads of the original vat.
- Apply a thin coat of grease to the vat pad where contact is made with the vat jacks (channels).
- Unload old vat using machine software.
- With old vat removed, resin removed from all surfaces, SLA chamber floor clean, elevator at its upper limit and vat jacks in the unload position, roll the empty new vat into the chamber for fitting.
- Using the machine software, raise the vat jacks until they contact the vat pads. Verify that the jack posts are seated in the vat pad channels.
- Continue to raise the jacks (which are now raising the vat) to a point just below the bottom of the rim.
- Lower the elevator slowly until the unit is in the rim.
- Check the clearance between the:
  - Vat walls and rim
  - Vat walls and blade
  - Vat walls and elevator arms
  - Vat walls and leveling system
- If vat is full, lower the vat until its weight is on the wheels.
- Adjust the front and back clearances by moving the vat pads within the slotted mounting holes where they bolt into the vat.

Appendix B: Vat Installation Procedure

- Adjust side-to-side clearances by adding shims to the needed side to move the vat pad away from the vat.
- After the clearance adjustments are correct, raise the vent to its upper limits, verifying that the vat walls do not come into contact with any object in the rim area.

Remember!

- Make sure blade is pulled slightly back so the vat does not hit it and lift the rim.

- When the vat has been fully loaded and the proper amount of resin has been added, verify that the resin level in the Zephyr blade is about half way up the viewing window. If it is not, remove the black cover of the SLA and adjust the vacuum until the resin is the correct height.

Appendix B: Vat Installation Procedure

For the SLA 250/30, please follow these instructions for installing a new vat:

- Remove cover from leveling plunger area.
- Remove the old resin from the vat and clean the vat until the resin is removed from all surfaces, including the leveling plunger and leveling reservoir.
- Clean the blade.
- Clean the elevator arms.
- Clean the resin from all surfaces inside the build chamber.
- Fill the vat to 1/2 inch below the fill line. (This will allow plenty of room for the resin to expand as it warms)
- Replace the cover on leveling plunger area.
- If the resin file does not exist, create one for the new resin. (The resin files are in the **c:/resin** directory)
- Load the resin file in the Change Resin Utility and verify that the Ec and Dp are correct.
- In the Recoater Utility, start the Adjust Resin Level utility and add resin if necessary.
- Verify the build start position is correct. (The platform should be 1/2 out of the resin)
- Using the software, move the elevator below the recoat bar.
- Exit the menu program. At the DOS prompt, enter “recoater/zoff”.
- Using the software, verify that the sweep works correctly then exit the Recoater Utility
- Enter “menu” at the DOS prompt to enter back into the menu program. Verify that the heater is on and set to 30°C. Before starting a run, verify that the lase is on and up to full power.

Appendix B: Vat Installation Procedure

For the SLA 250/30, please follow these instructions for installing a new vat:

- From the recoater utility of the menu program unload the vat.
- Once the vat unload is complete open the chamber door and slowly pull the vat drawer all the way out till it stops.
- Put the lid on the vat and fasten it on with the four clips.
- Lift the vat out of the drawer and place it on paper towels on the floor. (This is a 2 person job)
- Remove the old resin from the vat and clean the vat till the resin is removed from all surfaces of the vat.
- Clean the zephyr blade inside and out.
- Clean the elevator arms.
- Clean resin from all surfaces inside the build chamber.
- Place the empty and clean vat back in the vat drawer. Fill the vat to 1/2 inch below the fill line. (This will allow plenty of room for the resin to expand as it warms and prevent spills when pushing the vat drawer back in.)
- Push the vat drawer in till it stops. (If the chamber door will not close the vat is not in far enough).
- Load the vat with the menu software.
- If the resin file does not exist create one for the new resin. (The resin files are in the **c:/resin** directory.)
- Load the resin file in the Change Resin Utility and verify that the Ec and Dp are correct.
- In the Recoater Utility start the Adjust Resin Level utility and add resin if necessary.
- Verify that resin is about 1/2 way up the window in the zephyr blade. If it is not, use the vacuum adjustment on the lower left wall of the build chamber to set it properly. (2 screws need to be removed to access the adjustment knob)
- Verify the build start position is correct. (The platform should be 1/2 out of the resin)
- Using the software move the elevator below the recoat bar.

Appendix B: Vat Installation Procedure

- Exit the menu program.
- At the DOS prompt type “recoater/zoff”.
- Using the software verify that the sweep works correctly then exit the Recoater Utility.
- Type “menu” at the DOS prompt to enter back into the menu program.
- Verify that the heater is on and set to 30°C.
- Before starting a run verify the laser is on and up to full power.

Contact Information
Ordering and Customer Service

U.S. & Canada

Tel: 800-222-7189 (within the U.S. and Canada)
+1-847-468-7809 (outside the U.S. and Canada)

Fax: +1-847-695-1748

DSM Somos
1122 St. Charles St.
Elgin, IL 60120

Europe (Hoek van Holland, The Netherlands)

Tel: 011-31-174-315530
Fax: 011-31-174-315391

DSM Somos
Slachthuisweg 30
3151 XN Hoek van Holland, The Netherlands

Asia (Shanghai, China)

Tel: +86-21-61418188
Fax: +86-21-61417008

DSM Somos
11F The Headquarters Building
No. 168 Middle Xi Zang Road
Shanghai 200001 China

Technical Service

U.S. & Canada

John Schaefer
(512) 848-0570
john.schaefer@dsm.com

Greg Renshaw
(248) 819-9432
greg.renshaw@dsm.com

Rick Thomas
224-402-0962
richard.thomas@dsm.com

Jon Spragg
224-402-0917
jonathan.spragg@dsm.com

Europe (Hoek van Holland, The Netherlands)

Philippe Barcet
+33-67-34-77-482
philippe.barcet@dsm.com

Asia (Shanghai, China)

Li Ji-Hong
+86-137-0177-0771
Ji-Hong.li@dsm.com

Technical Service information is also available through our website. Please refer to page 2 of this guide, or...
Log on to **www.dsmsomos.com** for more information.

Contact Information

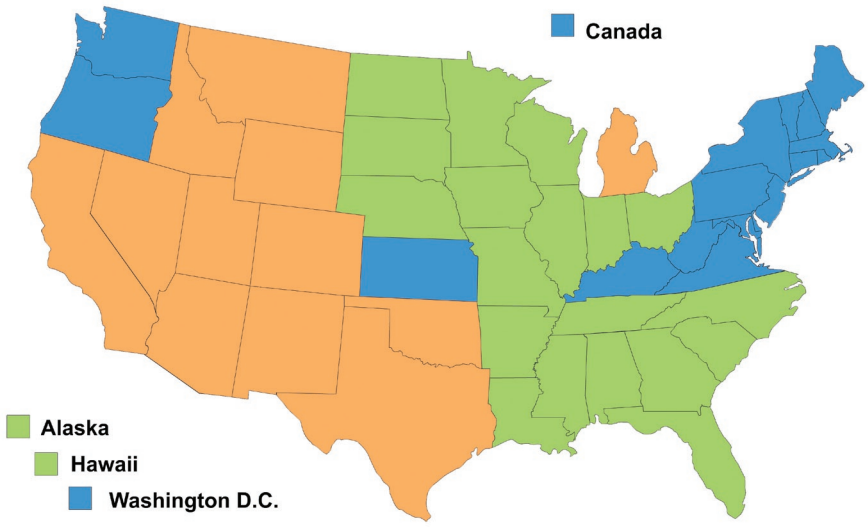
Sales

U.S. & Canada

Tom Rohrbeck
(224) 402-0954
thomas.rohrbeck@dsm.com

Charlie Kaufmann
(302) 897-4658
charles.kaufmann@dsm.com

Scott Nordlund
(224) 402-0923
scott.nordlund@dsm.com



Europe (Hoek van Holland, The Netherlands)

Arnaud Guedou
+33-60-84-10-663
arnaud.guedou@dsm.com

Anna Hoiss
+49-1722-4401-80
anna.hoiss@dsm.com

Asia (Shanghai, China)

Li Ji-Hong
+86-137-0177-0771
Ji-Hong.li@dsm.com